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INTERNATIONAL SYMPOSIUM ON MIMOSA PIGRA MANAGEMENT

Mimosa pigra, originally introduced into northern Thailand by farmers to prevent bank erosion of water channels, is now forming thickets impenetrable to either man or beast. The thorny shrubs keep men from their irrigation sources and cattle from their drinking water. The pernicious plant pest is also causing accumulation of water-carried soil, dramatically reducing irrigation flow to Thailand's rice fields. Some water channels have been filled up to 40%. Some islands are forming in the country's reservoirs.

Mimosa pigra

The International Plant Protection Center (IPPC) Aquatic Weed Program, University of Florida, in cooperation with the National Biological Control Research Center (NBCRC), Kasetsart University, will organize the International Symposium on *Mimosa pigra* Management from February 22-26, 1982, at Chiang Mai, Thailand.

The theme of the symposium will focus on the economic assessment of the problems created by *Mimosa pigra* in Thailand, threat of this introduced weed in the region, review of management effort, potential of biological control and other management practices, and other relevant matters. It is anticipated that certain recommendations and efforts will be generated from this conference for future and regional collaboration and cooperation to reach a sound management practice.

Participants will be invited from the USA, UK, Australia, Indonesia, Thailand and other countries where *Mimosa pigra* is a problem. However, funds cannot be provided and costs will have to be borne by their respective organizations.

Further information can be obtained from the following people:

Dr. Dale Habeck, Coordinator, IPPC Aquatic Weed Program, 3103 McCarty Hall, University of Florida, Gainesville, FL 32611

Dr. Banpot Napompeth, Director, National Biological Control Research Center, Kasetsart University, P.O. Box 9-52, Bangkok 9, Thailand

Mr. Lamar Robert, Project Coordinator, IPPC Mimosa pigra Control Project, MCP Building, Faculty of Agriculture, Chiang Mai University, Chiang Mai, Thailand.

Dr. Dale Habeck, Coordinator, IPPC Aquatic Weed Program, University of Florida.

AQUAPHYTE

Newsletter of the IPPC Aquatic Weed Program of the University of Florida, a part of the International Plant Protection Center of Oregon State University, which is funded by the United States Agency for International Development.

VOLUME 1, NUMBER 1 **FALL 1981**

TYPHA -- NOT JUST ANOTHER WEED!

Cattail is listed in many aquatic plant publications as an "aquatic weed." But to regard *Typha* (or any other plant) as merely a weed might blind us to the plant's beneficial possibilities.

Recent cattail research has made it clear again that the cattail is a plant which can be utilized from the base of its roots to the tip of its seedy spike.

Cattail has been used in all parts of the world as food, bedding, and roofing, and parts have been used to make basketry, shoes, rope and paper. Cattail ointments have been used for the treatment of snakebite, measles, insanity and many other disorders.

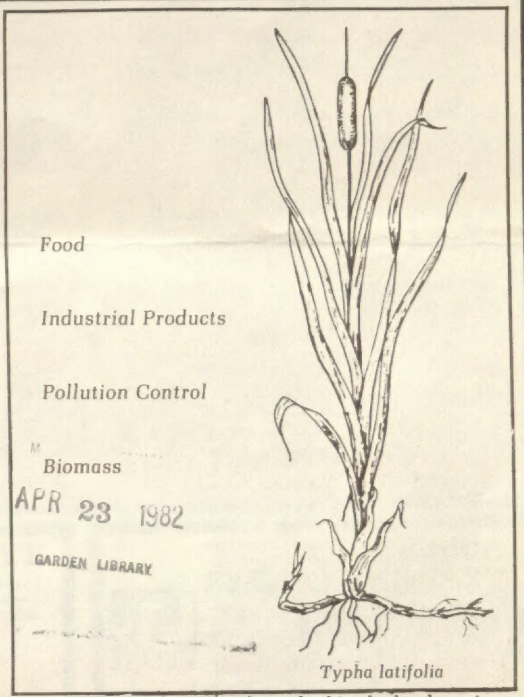
Modern scientists have discovered still other uses for the cattail. D.C. Pratt and N.J. Andrews of the University of Minnesota, and B.C. Wolverton and Rebecca C. McDonald of the National Aeronautics and Space Administration have studied *Typha* as a renewable source of energy: a high yield, manageable biomass crop which can be used for the production of methane gas.

Pratt and Andrews have determined that the above- and below-ground dry weight of the plant can exceed 40 tons per hectare. Wolverton and McDonald have calculated the potential gross energy content of one acre of cattail to be 301 million BTU's per year. Easily propagated from seed and having few significant insect pests, *Typha* appears to be a prime candidate to become an "energy crop."

Some scientists suggest that in the future, *Typha* might be planted on some of the 14 million acres of Minnesota-Wisconsin peatlands. Protein and carbohydrates could be extracted in large quantities, and the remainder of the biomass would be used in large anaerobic digesters to produce methane.

Other researchers are studying the use of cattails for the removal of nutrient pollution. According to C.E. Boyd, *Typha* can remove over 2600kg/ha/yr of nitrogen from polluted water (compared to 2000 for water hyacinth), and can remove 4500 kg/ha/yr of potassium (compared to 3200 for water hyacinth). He believes that cattail is one of four aquatic plants best suited for the managed removal of nutrients from polluted water.

In 1980, Marian Stephenson and her colleagues compiled much data in the form of tables and graphs on the nutrient and metal uptake of cattail and other aquatic plants for the purification of wastewater. (Their publication is described in the book review section of this newsletter.)



Typha latifolia

APR 23 1982
GARDEN LIBRARY

J.R. Wells has shown that *Typha* is "noteworthy in its high heavy metal concentrations." *Typha* could be a reasonable "bioindicator" of heavy metal pollution.

N.V. Morozov and A.V. Torpishcheva reported in 1977 that oil pollution is decomposed 3 to 10 times faster when cattails are present than when they are not. Microorganisms naturally associated with *Typha* and *Scirpus* oxidize petroleum products as their carbon source.

Food products derived from *Typha* have been described in many articles. Its root stock is dried and ground into flour; its pollen is an ingredient in bread. Its seeds are eaten as nuts. Its fruiting spikes are eaten roasted. Its young stem when eaten raw or cooked, is called "Cossack asparagus."

E.J. Staba has detected flavonols and beta-sitosterols in *Typha*. Both chemicals are used in the manufacture of medicines.

An industrial grade drying oil has been extracted from cattail seed. Cattail's buoyant down has been used in life preservers and mattresses. Its leaves have been manufactured into paper and fiberboard.

As of September, 1981, the Aquatic Weed Program had catalogued 81 articles on the utilization of *Typha*. The total number of articles catalogued in the database (in

Continued on page 2

MISSOURI BOTANICAL GARDEN LIBRARY

WATERMILFOIL UNDER ATTACK

The government of British Columbia, through the Ministry of Environment, maintains the very active and publicly visible Aquatic Studies Branch. Among other duties, it is responsible for the control of that province's most troublesome aquatic weed -- *Myriophyllum spicatum*.

Since 1971, British Columbia has studied the invasion of Eurasian water milfoil into the Okanagan Lake system. Nearly 100 research reports, as well as popular circulars, have been prepared and distributed by the Ministry.

Chemical, mechanical and biological controls of *Myriophyllum* have been systematically studied. An extensive public awareness program has been mounted to prevent the dispersal of *Myriophyllum* to other lakes by pleasure boaters.

Among their recent reports are:

Armour, G.D., R.S. Hanna, I.P. Walters, M.D. Maxnuk. 1980. Summary of mechanical aquatic plant management, Okanagan Valley, 1978. 36 pp.

Anon. 1980. Eurasian water milfoil treatments with 2,4-D in the Okanagan Valley, 1977-78. Vol. 2. Herbicide residue concentrations and persistence in biological tissues and hydrosoils. 72 pp.

Kangasiemi, B.J. Preliminary investigation of interstitial water chemistry of littoral sediments and the nutrition of *Myriophyllum spicatum* L. 21 pp.

Maxnuk, M.D. 1979. Evaluation of rotavating and diver dredging for aquatic weed control in the Okanagan Valley. 53 pp.

Rudolph, J.R., C.E.W. Dyer. 1981. Control of *Myriophyllum spicatum* in Kalamalka and Wood Lakes using 2,4-D butoxyethanol ester in 1980. 40 pp.

Scales, P., A. Bryan. 1979. Transport of *Myriophyllum spicatum* fragments by boaters and assessment of the 1978 boat quarantine program. 36 pp.

For further information, write:
Dr. P.R. Newroth, Manager,
Littoral Studies Section, Ministry of Environment, 777 Broughton Street, 4th Floor, Victoria,
British Columbia Canada V8V 1X5

SCIENTIST RETURNS TO INDIA

Tumular Ramaprabhu, after completing his one year fellowship sponsored by the International Development Research Centre in Canada has returned to his post at the Weed Control Unit, Central Inland Fisheries Research Substation in Cuttack, India. The fellowship enabled him to remain in residence at the University of Florida where he reviewed weed control techniques being developed at the Center for Aquatic Weeds. He also traveled elsewhere in the United States.

The 48-year-old India native has spent 20 years studying hydrilla, water hyacinth, blue-green algal blooms and salvinia infestation problems.

Ramaprabhu and his principal, C. Ramachandran, developed the use of anhydrous ammonia as a method of hydrilla control in the 1960s.

While in Florida, Ramaprabhu observed the work of R. Charudattan, plant pathologist, agronomist William Haller and fish biologist Jerome Shireman.

ASIAN TRAINING CENTER

BIOTROP and the SEAMEO Regional Center for Tropical Biology in Bogor, Indonesia, for over a decade have studied the ecosystems of Southeast Asia. Monographs, bibliographies and newsletters are regularly published by BIOTROP in many major subject areas of Asian biology.

Training courses in forestry, mycology, entomology, fish breeding, plant genetics, environmental sciences, curation, remote sensing and weed science have been conducted on a regular basis. These courses draw researchers and government personnel together to plan and execute programs throughout Indonesia and Southeast Asia.

BIOTROP's publications catalogue can be obtained from BIOTROP, Mrs. P. Sahertian-Bakhoven, Clearing House Manager, P.O. Box 17, Bogor. Indonesia.

Two of their recent aquatic weed reports are:

Mercado, B.L. 1979. Biology, problems and control of *Eichhornia crassipes* (Mart.) Solms. A Monograph. 52 pp.

Soerjani, M., J.B. Comber, G. Tjitrosoepomo, editors. 1979. Weed Problems in Southeast Asia. A collection of forty-one papers presented by Southeast Asian scientists to the Second Indonesian Weed Science Conference.

TYPHA

Continued from page 1

which *Typha* is a subject) is as follows:

T. latifolia	490
T. angustifolia	247
T. domingensis	52
T. angustata	44
T. glauca	28

Some *Typha* references:

Adriano, D.C., A. Fulenwider, R.R. Sharitz, T.G. Ciravolo, G.D. Hoyt. 1980. Growth and mineral nutrition of cattail (*Typha*) as influenced by thermal alteration. J. Environ. Qual. 9 (4): 649-653.

Andrews, N.J., D.C. Pratt. 1978. Energy potential of cattails (*Typha* spp.) and productivity in managed stands. J. Minn. Acad. Sci. 44 (2): 5-8.

Bernard, J.M., F.A. Bernard. 1973. Winter biomass in *Typha glauca* Godr. and *Sparangium eurycarpum* Engelm. Torr. Bot. Club. Bull., 100 (2): 125-131.

Boyd, C.E. 1970. Vascular aquatic plants for mineral nutrient removal from polluted waters. Econ. Bot. 24: 94-103.

Kvet, J., S. Husak. 1978. Primary data on biomass and production estimates in typical stands of fishpond littoral plant communities. pp. 211-216. In: Pond Littoral Ecosystems: Structure and Functioning. D. Dykjova and J. Kvet (eds). Springer-Verlag, New York, 1978.

Morozov, N.V., A.V. Torpishcheva. 1977. Microorganisms that oxidize petroleum and petroleum products in the presence of higher aquatic plants. Hydrobiol. J. 9 (4): 54-59.

Morton, J.F. 1975. Cattails (*Typha spp.*) - weed problem or potential crop? Econ. Bot. 29 (1): 7-29.

Pietsch. W. 1979. Classification and Possibilities of Utilization of the Opencast lakes in the Lausitz Lignite Area. Archiv. Natursch. Landshaftsforsh. 3(19):11-18.

Reed, E., L.C. Marsh. 1955. The cattail potential. Chemurgic Digest. 14(3):9-18.

Saha, L. 1968. The genus *Typha* in India-its distribution and uses. Botan. Soc. Benga. 22(1):11-18.

Staba, E.J. 1973. Alleviation of lake pollution by utilization of aquatic plants for nutritional, medicinal or industrial purposes. Minneapolis, Mn: Univ. Minn. Water Resources Center. 30 pp.

Steward, K.K. 1970. Nutrient removal potentials of various aquatic plants. Hyacinth Control J. 8(2):34-35.

Vorob'ev, A. 1973. The cattail, a vitamin-rich feed for cattle. Zemedelie 5:44-46.

Wells, J.R., P.B. Kaufman, J.D. Jones.

Continued on page 8

AQUAPHYTE

Newsletter of the IPPC Aquatic Weed Program of the University of Florida, a part of the International Plant Protection Center of Oregon State University, which is funded by the United States Agency for International Development.

VOLUME 1, NUMBER 1 FALL 1981

Editor: Victor Ramey

Comments, announcements, news items and other information relevant to aquatic plant research are solicited.

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BIOGAS PRODUCTION FROM HYDRILLA JUICE

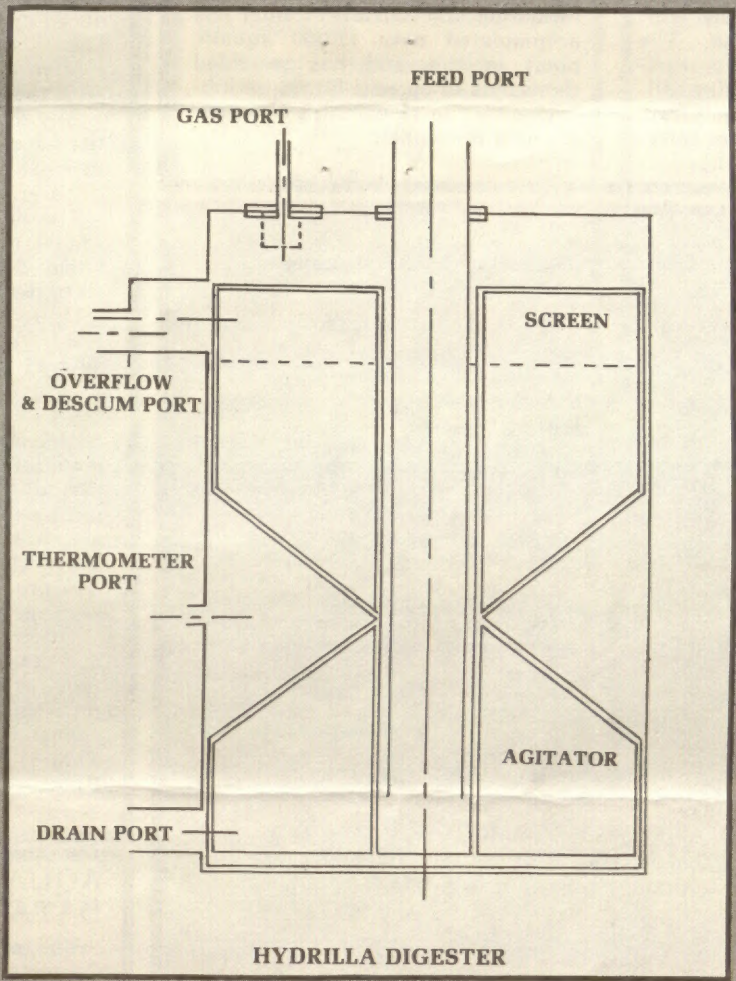
The University of Florida's Agricultural Engineering Department has been harvesting, processing and utilizing water hyacinth and hydrilla. One phase of study is the production of methane from "hydrilla juice" using anaerobic digesters.

Dr. Larry Bagnall, Associate Professor of Agricultural Engineering, began biogas research using 200 liter digesters. Now, he is building a 1,000 liter digester.

Biogas research is a natural consequence of Bagnall's years of utilizing aquatic weeds. He has studied the utilization of aquatic weeds as animal feed since the early 70s. When preparing animal feed, excess water must be squeezed from the aquatic plants. It is the extracted water (juice) that Bagnall is using in one of his methane digesters. The juice, according to Bagnall, is rich in nutrients which are essential to the bacteria which manufacture biogas.

By using the dried weed for silage and the by-product juice for biogas production, Bagnall utilizes the entire plant.

Bagnall and others continue to research the utilization of water hyacinth and hydrilla. Questions of nutritional value, elemental uptake, de-watering processes, temperature effect and others must be answered thoroughly before economical systems of utilization can be designed.



HYDRILLA DIGESTER

The schematic on this page is one of the digesters designed and built by Bagnall.

Fresh hydrilla is run through a 9-inch screw press at the rate of one to three tons per hour. The extracted nutrient-rich juice is injected into the bottom of a three-foot tall, 200 liter, airtight steel digester. Anaerobic bacteria, introduced from swamp mud or from effluent of previously digested material, begin producing biogas. The optimum temperature for digestion is 36 degrees Centigrade. Digesters can be heated by solar collectors or by the ambient air. The pH of the material entering the digester is between 5.3 and 5.8. The material in the digester is stirred to prevent stratification of material.

The produced gas is collected in a barrel inverted over water and vented periodically through a wet test gas meter to determine the volume of gas produced. Gas production increases with feed rate increase.

Rates of 84 liters of gas per day for the 200 liter digester have been achieved. The biogas produced is approximately 75% methane and 25% carbon dioxide. Bagnall said he did not find it necessary to separate the CO-2 in order to operate a three horsepower engine with the biogas.

Other projects producing methane from aquatic plants include the joint project between the governments of Sudan and West Germany. Small home-sized digesters are producing biogas from water hyacinths which grow on the Nile River.

Dennis Hanisak, LaVergne D. Williams and John H. Ryther produced methane from water hyacinth with a bioconversion efficiency of 47% in 1978-79. They suggest a system wherein nutrient enriched water hyacinths, grown in advanced sewage treatment ponds, would be regularly harvested for methane production. The by-product of methane production is a nitrogen-rich sludge which would replace fertilizer produced in more conventional ways.

References:

Bagnall, L.O. 1980. Methane from hydrilla. Proc. Fla. Aquat. Plant Manag. Soc. Orlando, Florida 15 pp.

Hanisak, M.D., L.D. Williams, J.H. Ryther. 1980. Recycling the nutrients in residues from methane digesters of aquatic macrophytes for new biomass production. Resource Recovery Conserv. 4:313-23.

Phillip, O., A. El Tayeb, B.H. Hag Yousif. 1979. Some studies and aims of the utilization of water hyacinth *Eichhornia crassipes* (Mart.) Solms, In: Weed Research in Sudan. Volume I. Proceedings of a Symposium. pp. 106-115. ed. by M.E. Beshir and Koch Wad Medani, Sudan: Univ. of Gezira, 152 pp.

Phillip, O., W. Koch, H.B. El Amin. 1979. Studies on the utilization of water hyacinth (*Eichhornia crassipes* Mart. Solms) in the Sudan. In: 3 Papers on the Population Dynamics Control and Utilization of *Eichhornia crassipes* in the Sudan, pp. 28-38. ed. by W. Koch and A. Kemmer. Stuttgart, Germany: Univ. Hohenheim, 38 pp.

Wolverton, B.C., Rebecca C. McDonald. 1981. Energy from vascular plant wastewater treatment systems. Econ. Bot. 35(2):224-232.

IPPC-FLORIDA AQUATIC WEED PROGRAM

In response to increased international concern for the problems of aquatic weed spread, the International Plant Protection Center's Aquatic Weed Program was born in 1976. The original goals to provide technical assistance and an information exchange system were developed by Dr. George E. Allen of the University of Florida. Dr. Allen became the first coordinator of IPPC-Florida. Funding for IPPC-Florida is provided by IPPC-Oregon State University, Corvallis, Oregon. The overall director of IPPC is agricultural economist Dr. Stanley Miller. Funding for IPPC-Oregon is from the United States Agency for International Development (A.I.D.).

In October, 1980, Dr. Allen moved to the Department of Agriculture's Science and Education Administration in Washington, D.C. Dr. Dale Habeck of the University of Florida replaced Dr. Allen as Coordinator of IPPC-Florida.

Since its beginning, IPPC-Florida personnel have traveled widely giving technical assistance on aquatic weeds and observing research programs in a large number of countries. IPPC-Florida has sponsored several international training courses and has arranged conferences on biological control of aquatic weeds. The Information and Retrieval Center has accumulated over 11,000 aquatic plant articles and has provided thousands of current literature bibliographies to researchers and government personnel.

HOW TO ORDER A BIBLIOGRAPHY

Researchers should make specific requests for searches. Some categories are hundreds of citations in length. Therefore, when ordering bibliography searches, users should combine categories and keywords with plant species of particular interest, such as:

* *Eichhornia crassipes* and utilization
* Heavy metal uptake in any aquatic plant
* *Azolla* used as a green manure
* Triploid studies since 1978 in herbivorous fishes
* Salinity tolerance in *Spartina alterniflora*
* Productivity of *Phragmites* in lakes
* Everything in the database on *Lemna minor*

KEYWORDS -- Any words can be used as KEYWORDS to be searched in the titles and in the new KEYWORDS category of the database such as:

*water level	*arsenic
*biomass	*elemental composition
*nitrogen fixation	*aquaculture
*turbidity	*toxicity

In addition, bibliographies can be produced according to authors and co-authors cited in the database. Please provide the full names and correct spellings for author and co-author searches.

All BIBLIOGRAPHIES are printed in alphabetical order according to PRIMARY AUTHOR.

Below is listed the retrieval categories for the Information and Retrieval Center. Next to each category is a number which indicates the approximate number of citations retrievable from that category.

PLANT NAME(S)

BIOLOGICAL CONTROL (1400)
- Animals
- Fish
- Insects
- Manatee
- Pathogens
- Plants
- Snails

CHEMICAL CONTROL (2000)
- Chemical Name

CULTURAL CONTROL (200)
- Water Level
- Fertilization
- Shading

DISTRIBUTION - COUNTRIES (2600)

ECOLOGY (3800)
- Lakes (Ponds)
- Reservoirs
- Wetland
- Marshes (Bogs, Swamps)
- Rivers (Streams, Irrigation Cannals, Channels)
- Estuaries (Bay)
- Primary Production
- Productivity
- Eutrophication
- Pollution (Toxicology)
- Nutrient Cycling
- Plant Succession
- Host Plants
- Herbicides
- Ecosystem
- Government Control
- Phenology
- Water Chemistry
- Water Quality

ECONOMICS (140)

INTEGRATED CONTROL (100)

KEYWORDS

MECHANICAL CONTROL (400)
- Mowing
- Dredging

MORPHOLOGY (500)
- Cytology
- Embryology
- Histology

PHYSIOLOGY (1600)
- Photosynthesis
- Transpiration

REPRODUCTION (700)
- Flowering
- Germination
- Ontogeny

REMOTE SENSING (100)

REVIEW (250)

SURVEY (150)

TAXONOMY (600)

TOXIC PLANTS (50)

UTILIZATION (700)
- Biogas
- Food
- Pollution Control

AQUATIC WEED INFORMATION AND RETRIEVAL CENTER

The Aquatic Weed Information and Retrieval Center collects information relating to freshwater aquatic macrophytes. The articles and books are catalogued by the program staff. The citations and keywords of the literature are entered into a computerized database. Computer generated bibliographies, corresponding to any combinations of species names, categories and keywords of the user's choice, are produced and mailed to users throughout the world. Over 300 individuals receive regular updates of citations from the database.

Any researcher or government entity is eligible to use this service. In most cases there is no charge to the user.

The database now includes over 11,000 papers and books. Several hundred articles per month are added to the database.

Users regularly send their reprints and bibliographies to be entered into the center's collection. Program staff scans current journal contents, article bibliographies and conference proceedings for additional materials. Computerized searches of the databases, made available through Lockheed's DIALOG information services, are conducted regularly. Many regional research centers around the world also submit relevant publications.

The job of collecting, cataloguing and disseminating this information requires hundreds of hours of computer and library work. Those responsible for this task are Victor Ramey, Barbara Janacek, Jennifer Roberts, Alexandria Patterson, Robyn Goodkind and Angela Gibbons.

AQUATIC PLANT DATA SOUGHT!!!

The International Plant Protection Center/Aquatic Weed Program has issued a request for references to articles and publications concerning all phases of freshwater aquatic plant identification, research, control, and management. Reprints are especially welcome.

Authors of aquatic plant publications and articles, in particular, are encouraged to submit material so that inquiries processed by the information storage and retrieval system can receive complete compilations of the most current information.

Please contact: IPPC/Aquatic Weed Program, 3103 McCarty Hall, Univ. of Florida, Gainesville, FL 32611 USA.

A SAMPLING OF ARTICLES RECENTLY ADDED TO THE DATABASE

Aquatic Macrophytes as Food Sources:

Becker, R.,K.Lorenz. 1981 Saccharides in wild rice (*Zizania aquatica*). Lebensm. Wiss. Technol. 14(3):134-36.

Bytniewska, K., W. Maciejewska-Potapczyk. 1980. Amino acid composition and biological value of protein in some aquatic plant species. Biochem. Physiol. Pflanz. 175:172-75.

Edwards, P. 1981. Water weeds as fish feed -- a potential weed control technique for Indonesia. Report to UNESCO. Bangkok, Thailand: Asian Institute of Technology. 14pp.

Gerard, C., J. Troncoso. 1980. Utilisation de la jacinthe d'eau (*Eichhornia crassipes*) par le lapin de chair. Rev. Elev. Med. Vet. Pays Trop. 33(1):91-96.

Sharma, D.N., A.K. Singh. 1980. The evaluation of leaf-protein quality in three aquatic plants. Aquat. bot. 8(3):279-84.

Widyanto, L.S. 1981. Side-effect of the utilization of polluted waterhyacinth for paddystraw mushroom culture medium. Proc. FAOB Symp. 3:1-10.

Aquatic Macrophytes and Pollution:

Clark, J.R., J.H. Vanhassel, R.B. Nicholson, D.S. Cherry, J. Cairns, Jr. 1981. Accumulation and depuration of metals by duckweed (*Lemna perpusilla*). Ecotoxicol. Env. Saf. 5:87-96.

Lee, C.R., T.C. Sturgis, M.C. Landin. 1981. Heavy metal uptake by marsh plants in hydroponic solution cultures. J. Plant Nutrition 3(1-4):139-151.

Nasu, Y., M. Kugimoto. 1981. *Lemna* (duckweed) as an indicator of water pollution. I. The sensitivity of *Lemna paucicostata* to heavy metals. Arch. Environ. Contam. Toxicol. 10:159-69.

Nelson, S.G., B.D. Smith, B.R. Best. 1981. Kinetics of nitrate and ammonium uptake by the tropical freshwater macrophyte *Pistia stratiotes* L. Aquaculture 24:11-19.

Samy, D.I.A., J.L. Gnanarethinam. 1980. Effect of distillery effluent on the growth of three aquatic macrophytes. Comp. Physiol. Ecol. 5(4):290-95.

Schierup, H.H., V.J. Larsen. 1981. Macrophyte cycling of zinc, copper, lead and cadmium in the littoral zone of a polluted and non-polluted lake. I. Availability, uptake and translocation of heavy metals in *Phragmites australis* (cav.) trin. Aquat. Bot. 11:197-210.

USERS OF THE CENTER MOST OFTEN REQUEST INFORMATION ABOUT THE FOLLOWING PLANTS

The number to the right of the plant name indicates the approximate number of articles in the database for that particular plant.

Alternanthera philoxeroides	350
Azolla caroliniana	150
Brasenia schreberi	100
Ceratophyllum demersum	550
Eichhornia crassipes	1200
Elodea canâdensis	500
Heteranthera dubia	100
Hydrilla verticillata	450
Juncus effusus	100
Lemna minor	500
Myriophyllum spicatum	500
Najas guadalupensis	200
Nuphar advena	100
Nymphaea odorata	200
Pistia stratiotes	300
Phragmites communis	400
Polygonum amphibium	100
Pontederia cordata	100
Potamogeton pectinatus	450
Ranunculus aquatilis	100
Sagittaria latifolia	150
Salvinia auriculata	100
Scirpus lacustris	100
Spartina alterniflora	150
Spirodela polyrhiza	200
Trapa natans	100
Typha latifolia	500
Utricularia	150
Vallisneria spiralis	150
Wolffia columbiana	100
Zannichellia palustris	100
Zizania aquatica	100
Zostera marina	100

MAKING AQUATIC WEEDS USEFUL: SOME PERSPECTIVES FOR DEVELOPING COUNTRIES

This report reviews methods for controlling aquatic weeds and using them to best advantage, especially those methods that show promise for less-developed countries. Free copies are still available from the Aquatic Weed Program.

Prepared by an ad hoc advisory panel of: the Board on Science and Technology for International Development; Commission on International Relations; National Research Council; whose members are drawn from the Councils of the National Academy of Sciences; the National Academy of Engineering; and the Institute of Medicine.

BOOKS

FOOD POTENTIAL OF AQUATIC MACROPHYTES. Peter Edwards. 1980. Manila, Philippines: International Center for Living Aquatic Resources Management. 51 pp.

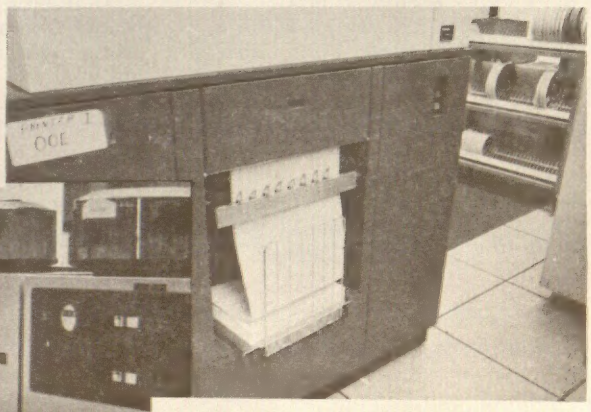
This book presents a critical review of the involvement of aquatic macrophytes in the food production process. Citing research in this area and presenting examples of current utilization, the author explores the role of aquatic macrophytes as an underexploited, or unexploited, widespread and very productive resource that often exists side by side with food

Continued on page 6

AQUATIC WEED COMPUTER

The Northeast (Florida) Regional Data Center (NERDC) provides the computer power essential to the operation of the Aquatic Weed Program.

Their large main frame computers are accessible to us by telephone from the terminals in our offices. All bibliographies and updates are retrieved from our database which is maintained on discs and tapes at NERDC on the University of Florida campus. The approximately 11,000 articles "on-line" occupy in excess of 30 million bits of computer storage. NERDC's 1000 line/minute printers make it possible for us to deliver readable original bibliographies rather than the poor quality photo-copies of the past.



Above: High speed printer;
At left: Bank of disc drives.

THE U.S. ARMY AND AQUATIC WEEDS

The Aquatic Plant Control Research Program (APCRP) of the U.S. Army Corps of Engineers at the Waterways Experiment Station (Vicksburg, Mississippi) maintains extensive programs for the control of aquatic weeds within the United States. APCRP provides technical assistance and conducts large scale field tests using all methods of aquatic weed control. Annual meetings provide a forum for the exchange of information and ideas among scientists.

The program is managed by Mr. J. Lewis Decell, Waterways Experiment Station, P.O. Box 631, Vicksburg, Mississippi 39180 and is directed by the Chief of Engineers of the U.S. Army in Washington, D.C. 20314.

Listed below are the technical reports published from January, 1980 through October, 1981. Free copies of these reports (while in print) may be obtained from Mr. W.N. Rushing of the Vicksburg office. More reports are expected in the months ahead.

In chronological order:

Janik, J.J., W.D. Taylor, J.W. Barko. 1980. A compilation of common algal control and management techniques. Tech. Report E-80-1. 53 pp.

Pemberton, R.W. 1980. Exploration for natural enemies of *Hydrilla verticillata* in Eastern Africa. Misc. Paper A-80-1. 30 pp.

Smith, P.A. 1980. Mechanical harvesting of aquatic plants. Report 2. Evaluation of selected handling functions of mechanical control. Tech. Report A-78-3. 121 pp.

Maceina, M., J.V. Shireman. 1980. Recording fathometer techniques for determining distribution and biomass of *Hydrilla verticillata* Royle. Misc. Paper A-80-5. 46 pp.

Barko, J.W., R.M. Smart, D.G. Hardin, M.S. Matthews. 1980. Growth and metabolism of three introduced submersed plant species in relation to the influences of temperature and light. Tech. Report A-80-1. 46 pp.

1980. PROCEEDINGS. 14th annual meeting, Aquatic Plant Control Research Planning and Operations Review. Misc. Paper A-80-3. 389 pp.

Foret, J.A., J.R. Barry, E.A. Theriot. 1980. Biological control agents on waterhyacinth at nineteen locations in Louisiana. Misc. Paper -80-4. 8 pp.

Baer, R.G., P.C. Quimby, Jr. 1980. Field studies and laboratory rearing of *Arzama densa* Wlk., a biological control agent against waterhyacinth. Misc. Paper A-80-6. 26 pp.

Steward, K.K. 1981. Improving technology for chemical control of aquatic weeds. Tech. Report A-81-2. 32 pp.

Freeman, T.E., R. Charudattan, K.E. Conway, R.E. Cullen, R.D. Martyn, D.E. McKinney, M.R. Olexa, D.F. Reese. 1981. Biological control of aquatic plants with pathogenic fungi. Tech. Report A-81-1. 48 pp.

Wlosinski, J.H. 1981. Workshop on modeling of aquatic macrophytes. Misc. Paper A-81-1. 24 pp.

Center, T.D. 1981. Release and establishment of *Sameodes albiguttalis* for biological control of waterhyacinth. Tech. Report A-81-3. 120 pp.

Buckingham, G.R., C.A. Bennett, B.M. Ross. 1981. Investigation of two insect species for control of Eurasian watermilfoil. Tech. Report A-81-4. 53 pp.

Theriot, E.A., R.F. Theriot, D.R. Sanders, Sr. 1981. Evaluation of the infectivity of a *Cercospora rodmanii* formulation using two application systems. Misc. Paper A-81-2. 26 pp.

Theriot, E.A., R.F. Theriot, D.R. Sanders, Sr. 1981. Evaluation of a formulation of *Cercospora rodmanii* for infectivity and pathogenicity of waterhyacinth. Tech. Report A-81-5. 42 pp.

Godley, J.S., R.W. McDiarmid, G.T. Bancroft. 1981. Large-scale operations management test of use of the white amur for control of problem aquatic plants. Baseline Studies. Vol. V. The Herpetofauna of Lake Conway. Techn. Report A-78-2. 111 pp.

1981. PROCEEDINGS. 15th annual meeting, Aquatic Plant Control Research Planning and Operations Review. Misc. Paper A-81-3. 508 pp.

BOOKS

Continued from page 5

shortages in underdeveloped countries. Edwards covers the use of this resource as food for both humans and animals, as well as the possibilities for fertilization and waste recycling.

PROCEEDINGS, BIO-ENERGY '80 WORLD CONGRESS AND EXPOSITION. April, 1980. Atlanta, Georgia, U.S.A.

A thorough collection of technical information on the production of energy and other products from plant biomass. Included are sections on overview of bioenergy, biomass sources, conversion processes and co-products, and national programs and systems of biomass use. 2100 typewritten pages have been photographically reduced to create this 586 page book. The Proceedings can be obtained from: The Bio-Energy Council, Suite 825A, 1625 Eye Street, N.W., Washington, D.C. 20006 U.S.A. Each copy costs $60, including postage.

THE USE AND POTENTIAL OF AQUATIC SPECIES FOR WASTEWATER TREATMENT. THE ENVIRONMENTAL REQUIREMENTS OF AQUATIC PLANTS. Marian Stephenson, Gwen Turner, Pamela Pope, John Colt, Allen Knight and George Tchobanoglous of the University of California at Davis, California State Water Resources Control Board, Sacramento, California, October, 1980. This 655 book is a comprehensive listing and review which compiles data of over 600 books and articles published through 1979. It includes an author index and an extensive subject index of the book's listed citations. The cost of the publication is $20 payable by check or money order to: Documents Section, Department of General Services, P.O. Box 1015, North Highlands, California 95660 U.S.A.

GRASS CARP BIBLIOGRAPHY. Charles R. Smith, Jerome V. Shireman. 1981. Center for Aquatic Weeds, Institute of Food and Agricultural Sciences, University of Florida, Gainesville, Florida. 179 pp.

More than a comprehensive bibliography, this book is a synopsis of the grass carp literature and is divided into 15 subject areas with 47 subheadings.

PROCEEDINGS OF THE CONFERENCE ON AQUATIC WEEDS AND THEIR CONTROL. R.J. Makepeace, Editor. 1981. Association of Applied Biologists-Weeds Group, in conjunction with the Association of Drainage Authorities and the National Water Council of Great Britain. 330 pp.

A collection of 35 articles presented in seven sessions. Sessions dealt with weed problems in land drainage and fisheries, the biology of aquatic weeds, current and future controls of aquatic weeds, ecological problems of weed control methods and herbicide usage in potable water supplies. Copies may be obtained from: The AAB Office, National Vegetable Research Station, Wellesbourne, Warwick. CV 35 9EF, United Kingdom.

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REMOTE SENSING

Remote sensing usually refers to the imaging of terrestrial and aquatic conditions from above -- either from airplanes or from satellites.

Interpretation of photography from low-flying and high-flying airplanes has been commonplace for decades. More recently, interpretation of computer imaging from satellites has greatly altered the physical scope of remote sensing. Both kinds of imaging have been successfully used in the mapping of aquatic vegetation. Both have been used to observe aquatic pollution, turbidity, currents and many other aspects of the aquatic environment.

Remote sensing of aquatic vegetation has been accomplished by several research groups. Prominent among these groups are the Remote Sensing Institute of South Dakota State University, the Institute for Environmental Studies of the University of Wisconsin and the National Aeronautics and Space Administration (NASA).

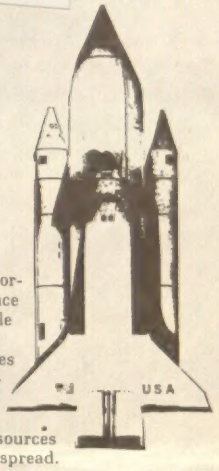
R.G. Best, M.E. Wehde and R.L. Linder have published the most recent article on the remote sensing of aquatic plants. *Spectral Reflectance of Hydrophytes* (1981. Remote Sens. Environ. 11:27-35), gives spectral reflectance figures of 10 species of waterplants during the phenological stages early emergence, flowering and seeding, and senescense. "Among the ten species," they wrote, "only one could not be spectrally isolated during at least one phenological stage."

A collection of remote sensing articles is included in the *Assessment of Aquatic Environment by Remote Sensing* (1977. University of Wisconsin, I.E.S. Report #84). This collection includes a definition of the nature of aquatic environments, water quality parameters, modeling information and the technical application of remote sensing techniques in determining water quality, macrophyte populations and many other aquatic conditions.

June and September are the optimum marsh mapping times in Louisiana, according to M. Kristine Butera. She is the author of NASA Technical Memorandum 58212 -- *A Determination of the Optimum Time of Year for Remotely Classifying Marsh Vegetation from Landsat Multispectral Scanner Data*. She analyzed the Landsat satellite data at the NASA/Earth Resources Laboratory (ERL) in Slidell, Louisiana. The work also concludes that for individual species mapped by satellite, "April appeared to be the best month to map *Juncus roemerianus*; May, *Spartina alterniflora*; June, *Baccharis halimifolia* and September, *Spartina patens* and *Distichlis spicata*."

The Aquatic Weed Program has catalogued almost 100 articles in the new category *Remote Sensing* of aquatic plants. Some other reports include:

Adams, M.S., F.L. Scarpace, J.P. Scherz, W.J. Woelkerling. 1977. Assessment of aquatic environment by remote sensing. I.E.S. Report #84. To order, write: Communications Office, Institute for Environmental Studies, University of Wisconsin at Madison, 610 Walnut Street, 120 WARF Building, Madison, Wisconsin, 53706 U.S.A.



The Space Transportation System(Space Shuttle) will enable manned remote sensing laboratories to operate indefinitely, studying among other subjects, water resources and aquatic plant spread.

Bartlett, D.S., V. Klemas. 1980. Quantitative assessment of emergent *Spartina alterniflora* biomass in tidal wetlands using remote sensing. In: Modeling, Marine Science Vol. II. pp. 425-36. Ed. by P. Hamilton, K.B. MacDonald. New York, Plenum Press. 653 pp.

Benton, Arthur R. Jr. 1980. Remote sensing of aquatic plants. In: Weed Control Methods for Public Health Applications, pp. 45-46. Ed. by E.O. Gangstad. Boca Raton, Florida. CRC Press. 301 pp.

Gustafson, T.D., M.S. Adams. 1973. Remote sensing of *Myriophyllum spicatum* L. in a shallow, eutrophic lake. Remote Sensing Water Resour. Manage. 17:387-91.

Long, K.S. 1979. Technical report A-79-2; U.S. Army Engineering Waterways Experiment Station, Vicksburg, Mississippi 39180.

Moore, G.K. 1980. Satellite remote sensing of water turbidity. Hydrol. Sci. Bull. 25(4):407-21.

SOME AGENCIES RELEVANT TO AQUATIC RESEARCHERS

Agricultural Research Council; Weed Research Organization, Begbroke Hill, Yarnton Oxford OX5 1PF, Great Britain

American Phytopathological Society; 3340 Pilot Knob Road, St. Paul, Minnesota 55121 U.S.A.

Aquatic Plant Control Research Program; United States Army Corps of Engineers, Waterways Experiment Station, P.O. Box 631, Vicksburg, Mississippi 39180 U.S.A.

Aquatic Studies Branch; Ministry of Environment, Parliament Buildings, Victoria, British Columbia, Canada V8V 1X4

Aquatic Weed Center; Institute of Food & Agricultural Sciences, University of Florida, Gainesville 32611 U.S.A.

Asian Institute of Technology; P.O. Box 2745, Bangkok, Thailand

The Bio-Energy Council; Suite 825A, 1625 Eye Street, N.W., Washington, D.C. 20006 U.S.A.

BIOTROP, SEAMEO Regional Center for Tropical Biology; P.O. Box 17, Bogor, Indonesia

Commonwealth Institute of Biological Control; Gordon Street, Curepe, Trinidad, West Indies

CSIRO; Long Pocket Laboratories; Private Bag, Indooroopilly, Queensland 4068, Australia

Food and Agricultural Organization of the United Nations; Via delle Terme di Caracalla, 00100 Rome, Italy

Freshwater Biological Association; East Stoke Wareham, Dorset BH20 6BB, Great Britain

Ijsselmeerpolders Development Authority; Postbus 600, 8200 Ap, Lelystad, The Netherlands

Institute of Environmental Studies; University of Wisconsin, Madison, Wisconsin 53706 U.S.A.

Instituto Nacional de Limnologia; Laboratorio de Macrofitas, Jose Macia 1933, 3016 Santa Tome (S.F.), Argentina

International Association of Aquatic Vascular Plant Biologists; c/o Dr. C. Peter McRoy, Institute of Marine Sciences, University of Alaska, Fairbanks, Alaska 99701 U.S.A.

International Center for Aquaculture; Auburn University, Auburn, Alabama 36830 U.S.A.

International Center for Living Aquatic Resources Management; ICLARM, Mcc P.O. Box 1501, Makati, Manila, Philippines

International Institute of Tropical Agriculture; P.O. Box 5320, Ibadan, Nigeria

International Plant Protection Center; Oregon State University, Corvallis, Oregon 97331 U.S.A.

International Rice Research Institute; P.O. Box 933, Manila, Philippines

International Weed Science Society; Oregon State University, Corvallis, Oregon 97331 U.S.A.

Malaysian Agricultural Research and Development Institute; Pertanian, Malaysia

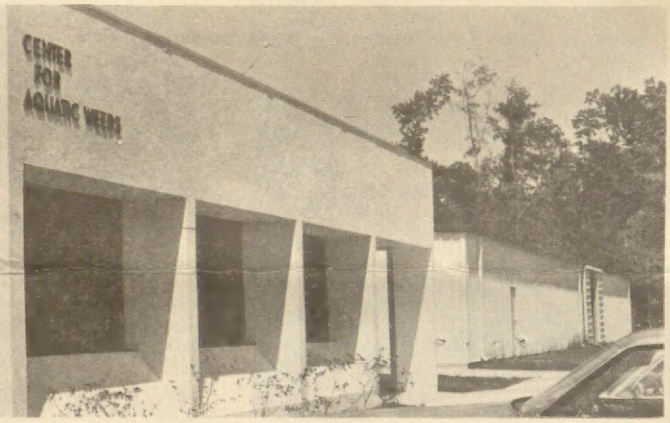
National Botanical Research Institute; Lucknow-2260011 India

National Coordinating Committee on Aquatic Weeds; Dept. of National Development and Energy, Australian Water Resources Council, P.O. Box 5, Canberra, ACT 2600, Australia

Research Institute for Botany; Hungarian Academy of Sciences, 2163 Vacratot, Hungary

FLORIDA'S CENTER FOR AQUATIC WEEDS

The Center for Aquatic Weeds is a multidisciplinary unit which conducts research and educational programs throughout Florida on the management of aquatic plants. A functional part of the University of Florida's Institute of Food and Agricultural Sciences (IFAS), this Center was designated by the 1978 Florida Legislature to be the state's lead agency for coordinating and developing research projects related to noxious aquatic plant control. Its director is Dr. Arnett Mace, 138 Newins-Ziegler Building, University of Florida, Gainesville, Florida 32611.



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1980. Heavy metal contents in some macrophytes from Saginaw Bay (Lake Huron, USA). Aquatic Botany 9:185-93.

Westlake, D.F. 1963. Comparisons of plant productivity. Biol. Rev., 38:385-425.

White, J.M., L.R. Sinclair. 1979. Effect of plant spacing on growth and yield of transplanted cattails. Soil and Crop Sci. Soc. Florida. 38:18-20.

Wolverton, B.C. 1980. Vascular plants for water pollution control and renewable sources of energy. In: Proceedings: Bio-Energy '80 World Congress and Exposition. April 21-24, 1980. The Georgia World Congress Center, Atlanta, Georgia, USA.

STRONTIUM AND AQUATIC PLANTS

A Search of the Aquatic Weed Database using the Keyword *Strontium* retrieved the following articles.

Chebotina, M., A.P. Yagov. 1979. Kinetics of the exchange of 90SR strontium isotope between *Elodea* and the water environment. Ekologia. Sept./Oct. (5):80-81. (In Russian.)

Chebotina, M., A.P. Yagov. 1979. Kinetics of strontium-90 exchange between *Elodea* and an aqueous medium. Soviet J. Ecol. 10(5):435-36.

Leinerte, M.P. 1969. Effect of external gamma-irradiation of higher aquatic plants on their accumulation of strontium-90, cesium-137 and cesium-144. Radiobiologiya. 9(3):427-32.

Nyanishkene, V.M.B., G.G. Polikarpov. 1970. Quantitative characterization of the means of strontium 90 intake into the body of gastropods. Radiobiologiya. 10(6):928-30.

Ophel, I.L., C.D. Fraser. 1970. Calcium and strontium discrimination by aquatic plants. Ecology. 55(2):224-27.

Ownes, M., N.S. Thom, G.E. Eden. 1961. The uptake and release of radioactive strontium by freshwater plants. Proc. Soc. Water Treatment Examiners. 10:53-65.

Piskunov, L.I., S.I. Treiger. 1970. Discrimination of strontium-90 in relation to calcium in fresh water plants. Radiobiologiya. 10(5):788-90.

Schroeder, P.B., A. Thorhaug. 1980. Trace metal cycling in tropical-subtropical estuaries dominated by the seagrass *Thalassia testudinum*. Amer. J. Bot. 67(7):1075-88.

CONFERENCES

January 19-21, 1982: Southern Weed Science Society annual meeting, Atlanta, Georgia, USA.

February 8-11, 1982: Weed Science Society of America annual meeting, Boston, Massachusetts, USA

February 11-12, 1982: Ghana Weed Science Society, Second Annual Conference, University of Ghana, Legon, Ghana

February 22-26, 1982: International Symposium on *Mimosa pigra* Management, Chiang Mai, Thailand. *(Story on page 1)*

June 21-25, 1982: Aquatic Weed Short Course, University of Florida, Institute of Food and Agricultural Sciences, Gainesville, Florida, USA

July 18-21, 1982: 22nd Annual Meeting of the Aquatic Plant Management Society, Caesar's Palace, Las Vegas, Nevada, USA.

September 20-25, 1982: European Weed Research Society, 6th International Symposium on Aquatic Weeds, Novi Sad, Yugoslavia

September 20-25, 1982: 2nd International Conference on Herbivorous Fish, Novi Sad, Yugoslavia.

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